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The Trees of Indiana in Their Local and General Distribution According to Physiographic Divisions

ALVA J. LINDSEY

Plankton Algæ of White River in Marion County and Morgan County, Indiana

C. MERVIN PALMER

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THE TREES OF INDIANA IN THEIR LOCAL AND GENERAL DISTRIBUTION ACCORDING TO PHYSIOGRAPHIC DIVISIONS

By ALVA J. LINDSEY

In light of the fact that no extensive work exists in plant geography showing the relation between Indiana trees and their physiographic distribution, the present problem was undertaken. It deals with the distribution of Indiana trees within the state by counties, but essentially by natural botanical areas; and outside of the state in their wider distribution by larger physiographic units.

LOCAL AND GENERAL DISTRIBUTION

The trees of Indiana to which reference is made are those one hundred and sixty-three species, varieties and forms which Charles C. Deam (5) recognizes as habitating within the state. Their distribution follows largely the ranges fixed by Deam, and, in addition, the Butler University Catalogue of Indiana plants, which records by counties all published records for each species. All of these trees do not represent taxonomic harmony; nor is the distribution of all agreed upon by those who have cared to map their ranges. Wherever conflict exists regarding either or both of the problems of classification and distribution, the authority of Deam is given precedence.

Indiana is divided into ninety-two counties for political and judicial administration. Topographically and geologically the state falls into six major botanical areas as indicated by Deam (6). The local range of a tree is therefore determined on this twofold division; first by counties, and secondly by botanical areas.

DISTRIBUTION BY COUNTIES

It was necessary, at first, to determine the range of a species by counties, due to the fact that herbarium and published records of distribution refer to location largely by counties. And, furthermore, it was expedient to map county distribution; for the small units of counties permitted a more accurate range determination than if larger units had been employed. Therefore, compelled by restriction of available data, and for the purpose of the greatest possible accuracy, county distribution became the indispensable and primary step. But, as an end in itself, county distribution has little ecological significance for the problem in hand. As a means, it lends invaluable aid in districting the trees by botanical areas. Certain counties and parts of counties compose a botanical area. When once the county location of a species was learned, it automatically became the resident of the botanical area in which the county was located.

The presence of a species within a county has no reference whatsoever to its frequency of occurrence. Whether appearing but once or in greater density, the county is credited with possessing the species, without trying to indicate its abundance. To show true abundance would be a limitless and almost impossible undertaking, not to mention the dearth of data for such an endeavor.

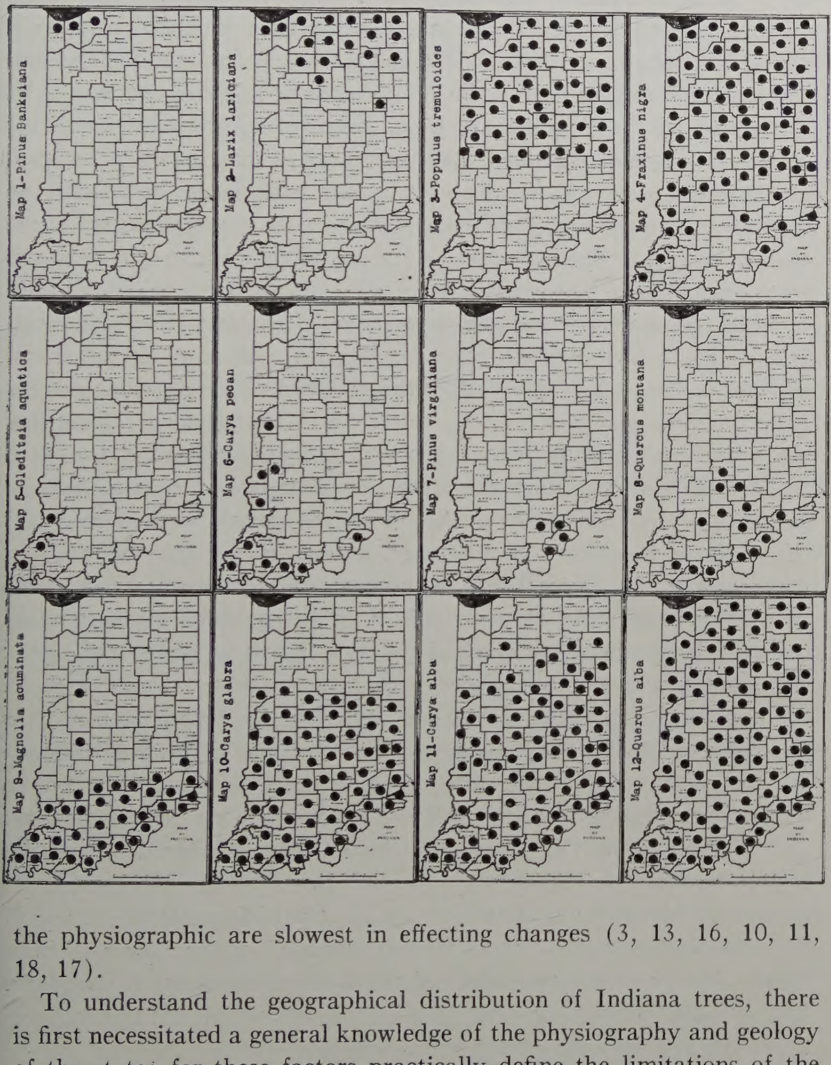
Maps 1-12 illustrate the method of treating each species. The maps are printed on 3 in. x 5 in. cards. Each county record is indicated by a circular dot of black gummed linen. The reverse side of the card is blank and can carry notes relative to factors pertaining to the species. This method has proved satisfactory in the present study and is recommended for all problems of this nature.

DISTRIBUTION BY BOTANICAL AREAS

The fact that a species is confined to a certain part of the state, at present, does not preclude the possibility of a change in its known range in the future. It is probable that some species will enlarge their ranges, while others will be doomed to occupy an ever-decreasing area. The dynamics of vegetation reveal that a species advances or retreats in relation to the hospitality of its constantly changing environment.

Some of the environmental changes which have influenced the distribution and abundance of trees, and are still active, include the biotic, anthropeic, climatic, physiographic, geologic, edaphic, catastrophic and other factors. For example, the biotic factor as expressed in grazing, and the anthropeic factor as expressed in agriculture, lumbering and drainage, have been a great influence in effecting the diminution of the forests of the state during the last century. This statement is made despite our meager knowledge of their past history. Concomitant with this deforestation has been the increase in abundance of "old field" and "weed" trees, such as Sassafras and Diospyros. But of all the factors, the climatic and

MAPS 1-12. SHOWING METHOD OF TREATING EACH SPECIES BY COUNTIES AND SOME TYPES OF DISTRIBUTION FOUND IN INDIANA



the physiographic are slowest in effecting changes (3, 13, 16, 10, 11, 18, 17).

To understand the geographical distribution of Indiana trees, there is first necessitated a general knowledge of the physiography and geology of the state; for these factors practically define the limitations of the botanical areas which are of prime importance in this discussion. Coulter and Thompson (2) have stressed the relationship between topography and geology on the one hand and vegetational dispersal on the other.

In describing Indiana topographically, they say it is a plain sloping in general to the west and southwest, having its highest altitude in the east central part and its lowest elevation between the Ohio and Wabash rivers in the extreme southwestern part. From the elevated region the streams run and the land slopes in every direction. The entire northern region has been covered with drift deposit which has modified its soil. The extreme northwestern counties are more or less covered with drift sand from old Lake Michigan, which once extended to the south far beyond its present location. The remainder of the northern counties are characterized by their many morainic basins and lakes. In the western counties is found the eastern limit of the western prairie, while most of the Ohio river counties and those of the southern interior are quite diversified in topographic make-up.

While topography reveals the contour and features of the earth's surface, which in turn regulates in part the amount of available water and sunlight for vegetational use, it is the geologic structure which largely determines the nature of the soil. Coulter and Thompson (2), following the geology of Indiana prepared by Collett (1), recognize dissimilar geologic formations within the state. In short, they describe Indiana geologically after this fashion. In the southeastern counties are found the rocks of the Lower Silurian age, known as the Hudson river or Cincinnati group. Immediately to the west and northwest of the Lower Silurian are the rocks of the Upper Silurian age. This formation extends to the northern boundary of the state, but it is here in the northern counties where it is surfaced with drift deposits. Devonian rocks are also found in the northern part, and, like the Upper Silurian, are covered with drift. The Devonian rocks continue southward throughout the central part of the state, reaching the Ohio river. The Lower Carboniferous rocks form the surface strata in a wide belt to the west and adjacent to the Devonian strip. Shales and sandstone dominate the eastern part of this region, while in the western part is the great limestone area of the state. The rocks of the Coal Measures are found in the southwestern part of the state, including all of the Lower Wabash Valley and extending two-thirds of the way up the western boundary. The northern part of the Coal Measure is not continuous, but is interrupted by alternations of the Lower Carboniferous.

In view of these topographical and geological features, Coulter and Thompson (2) divided the state into seven distinct botanical regions, each differentiated from the others in conditions of soil, moisture, topography and, consequently, in climate and vegetation. The seven regions are here listed with the counties which in general make up the areas:

THE LOWER WABASH VALLEY REGION, including all or parts of the following counties: Posey, Vanderburgh, Gibson, Pike, Knox, Daviess, Green, Sullivan, Clay and Vigo.

THE PRAIRIE REGION, extending over all or parts of the following counties: Vermilion, Fountain, Montgomery, Warren, Tippecanoe, Benton, Newton and White.

THE REGION OF "BARRENS," for the most part composed of the following extreme northwestern counties: Porter, Lake, Laporte, Starke, Pulaski, Jasper, Newton, and a small portion of the southern part of the state.

THE LAKE REGION, including most of the following northern and northwestern counties: Steuben, Lagrange, Elkhart, St. Joseph, Laporte, Starke, Marshall, Kosciusko, Noble, Dekalb, Allen, Whitley, Fulton, Pulaski, Cass and Wabash. This region is thickly covered with small lakes.

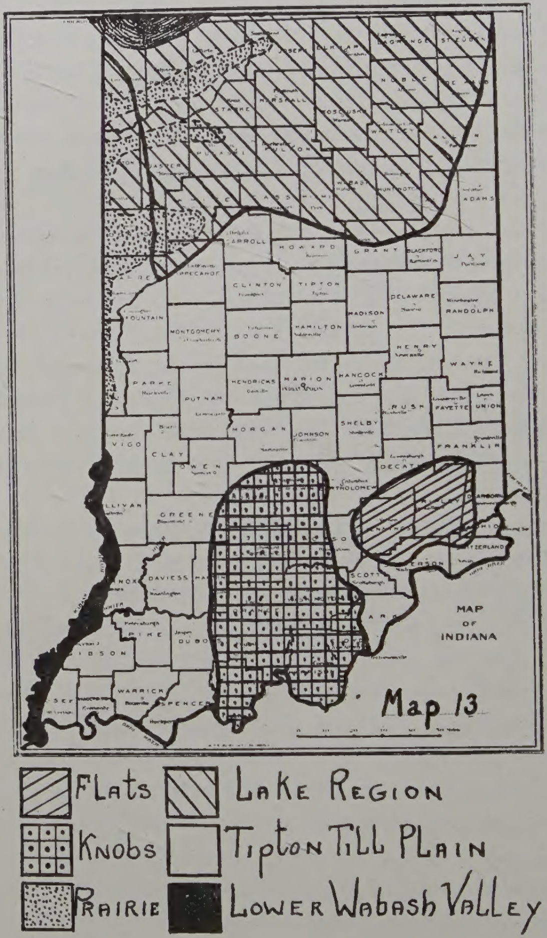
THE HIGHLAND REGION, including all or parts of the following counties: Adams, Wells, Huntington, Jay, Blackford, Grant, Madison, Delaware, Randolph, Henry, Wayne, Fayette and Union.

THE OHIO VALLEY REGION. This region includes all of the rough, broken country of the Ohio valley, and extends through the following counties: Franklin, Dearborn, Ohio, Switzerland, Ripley, Jefferson, Jennings, Clark, Scott, Jackson, Washington, Floyd, Harrison, Crawford, Orange, Lawrence, Martin, Perry, Dubois, Spencer and Warrick.

THE CENTRAL REGION, including all of the remaining counties in the central part of the state, which, to some extent, are characterized by all the topographical features of the other six regions. They are composed, for the most part, of woodland with streams and valleys of various sizes, and gently rolling land between.

Deam (6) recognizes six instead of seven botanical areas. He has modified in some respects the divisions of Coulter and Thompson. His most noticeable modifications are seen in the following changes: The northern "Barrens" and the Lake region are united under the name of the latter. The Highland region, the Central region, and part of the Lower Wabash Valley region are consolidated under the name of the Tipton Till Plain. The Ohio Valley region is divided into the distinct areas of "Knobs" and "Flats." The Lower Wabash Valley region is reduced to a narrow margin paralleling the lower Wabash river. In the

MAP 13. DEAM'S BOTANICAL AREAS OF INDIANA



present discussion, the botanical areas of Deam, and not those of Coulter and Thompson, have been followed. Map 13 shows the outline of Deam's areas.

From the maps which showed county distribution, a list of the species occurring in each of Deam's botanical areas was prepared. In Table I are given the location of species by botanical areas, the number of species in each area, and the percentage in each area of the total number of trees found in the state.

TABLE I—TREES OF INDIANA AND THEIR LOCATION BY BOTANICAL AREAS

Explanation of Column Headings—AC, All Counties; L, Lake region; TP, Tipton Till Plain; P, Prairie region; LWV, Lower Wabash Valley region; K, Knobs region; F, Flats region.

Boldface type indicates that the species is confined to one botanical area.

NAME OF SPECIES	AC	Region of Location L	TP	P	LWV	K	F
Acer negundo L.	x						
Acer negundo var. violaceum Kirchner		x	x		x	x	
Acer nigrum Michx. f.		x	x		x	x	
Acer nigrum var. Palmerii Sarg.			x			x	
Acer rubrum L.		x	x		x	x	x
Acer rubrum var. **Drummondii** (Hook. & Arn.) T. & G.					x		
Acer saccharum Marsh.		x	x		x	x	
Acer saccharum var. Schneckii Rehder					x	x	
Acer saccharum var. **Rugelii** (Pax) Rehder			x				
Acer saccharinum L.	x						
Æsculus glabra Willd		x	x		x	x	x
Æsculus octandra Marsh						x	
Ailanthus altissima (Mills.) Swingle			x			x	
Alnus incana (L.) Mœnch		x					
Amelanchier canadensis (L.) Med		x	x			x	x
Amelanchier laevis Wiegand		x	x			x	
Asimina triloba (L.) Dunall		x	x		x	x	x
Betula lutea Michx. f.		x					
Betula nigra L.		x	x		x	x	x
Betula papyrifera Marsh.		x					
Betula populifolia Marsh.		x					
Carya alba (L.) K. Koch			x		x	x	x
Carya alba var. **subcoriaceæ** Sarg.					x		
Carya Buckleyi var. **arkansana** Sarg.					x		
Carya cordiformis (Wang.) K. Koch	x						
Carya glabra Mill.			x		x	x	x
Carya glabra var. **megacarpa** Sarg.			x				
Carya laciniosa (Michx. f.) Loud		x	x		x	x	x
Carya ovalis (Wang.) Sarg.		x	x		x	x	x
Carya ovalis var. obcordata (Muhl.) Sarg.		x	x		x	x	
Carya ovalis var. **obcordata** f. **vestita** Sarg.					x		
Carya ovalis var. obovalis Sarg.		x	x		x	x	
Carya ovalis var. **obovalis** f. **acuta** Sarg.		x					
Carya ovalis var. odorata (Marsh.) Sarg.		x	x		x		x
Carya ovata (Mill.) K. Koch	x						
Carya ovata var. fraxinifolia Sarg.		x			x		

	REGION OF LOCATION						
NAME OF SPECIES	AC	L	TP	P	LWV	K	F
Carya ovata var. Nuttallii Sarg.		x					
Carya pecan (Marsh.) Engl. & Graeb.			x		x		x
Carpinus caroliniana Walt.		x	x		x	x	x
Castanea dentata (Marsh.) Borkh.						x	
Catalpa bignonioides Walter		x			x	x	
Catalpa speciosa Warder		x	x		x		
Celtis lævigata Willd.			x		x		
Celtis occidentalis L.	x						
Celtis pumila (Muhl.) Pursh.		x			x	x	
Cercis canadensis L.		x	x		x	x	x
Cornus florida L.		x	x		x	x	x
Cratægus basilica Beadle		x					
Cratægus calpodendron (Ehrh.) Med.		x	x	x	x	x	
Cratægus chrysocarpa Ashe		x	x				
Cratægus coccinea L.		x	x		x	x	x
Cratægus coccinea var. Ellwangeriana Eggleston			x				
Cratægus coccinioides Ashe		x	x		x	x	
Cratægus collina Chapman							x
Cratægus Crus-galli L.		x	x		x	x	x
Cratægus cuneiformis (Marsh.) Eggleston		x	x		x	x	
Cratægus filipes Ashe						x	
Cratægus Gattingeri Ashe		x			x	x	
Cratægus Jesupi Sarg.			x				
Cratægus macrosperma Ashe		x	x			x	
Cratægus macrosperma var. matura (Sarg.) Eggleston		x					
Cratægus Margaretta Ashe		x	x			x	
Cratægus mollis (T. & G.) Schelle		x	x		x	x	x
Cratægus neo-fluvialis Ashe		x	x				
Cratægus nitida (Engelm.) Sarg.					x		
Cratægus Phaenopyrum (L. f.) Med.			x				
Cratægus pruinosa (Wendl.) K. Koch		x	x		x	x	
Cratægus punctata Jacq.		x	x		x		x
Cratægus rugosa Ashe			x			x	x
Cratægus succulenta Schrader		x	x				
Cratægus viridis L.					x		
Diospyros virginiana L.			x		x	x	x
Fagus grandifolia Ehrh.		x	x		x	x	x
Foresteria acuminata (Michx.) Poir					x		
Fraxinus americana L.		x	x		x	x	x
Fraxinus americana f. iodocarpa Fernald		x	x			x	
Fraxinus biltmoreana Beadle			x		x	x	x
Fraxinus lanceolata Borkh.		x	x		x	x	x
Fraxinus nigra Marsh.		x	x		x		
Fraxinus pennsylvanica Marsh.		x	x		x	x	

	Region of Location						
NAME OF SPECIES	AC	L	TP	P	LWV	K	F
Fraxinus profunda Bush		x	x		x		
Fraxinus quadrangulata Michx.		x	x			x	x
Gleditsia aquatica Marsh					x		
Gleditsia texana Sarg					x		
Gleditsia triacanthros L.		x	x		x	x	x
Gynmocladus dioica (L.) K. Koch		x	x		x		
Juglans cinerea L.		x	x		x	x	x
Juglans nigra L.	x						
Juniperus virginiana L.		x	x		x	x	x
Larix laricina (Du Roi) K. Koch		x					
Liquidambar styraciflua L.		x	x		x	x	x
Liriodendron tulipifera L.		x	x		x	x	x
Maclura pomifera (Raf.) Schneider		x	x	x	x	x	x
Magnolia acuminata L.			x		x	x	x
Malus glaucescens Rehder		x	x		x	x	x
Malus ioensis (Wood) Britt		x	x	x	x	x	
X Malus ioensis X lancifolia		x					
Malus lancifolia Rehder		x	x		x		x
Morus alba var. tatarica (L.) Loud.		x				x	
Morus Rubra L.		x	x		x	x	x
Nyssa sylvatica Marsh		x	x		x	x	x
Ostrya virginiana (Mill.) K. Koch		x	x		x	x	x
Ostrya virginiana var. glandulosa (Spach.) Sarg		x	x			x	x
Oxydendrum arboreum (L.) De Candolle						x	
Pinus Banksiana Lam		x					
Pinus Strobus L.		x	x			x	
Pinus virginiana Mill.						x	
Platanus occidentalis L.		x	x		x	x	x
Populus alba L.	x						
Populus balsamifera L.		x					
Populus deltoides Marsh.		x	x		x	x	x
Populus grandidentata Michx.		x	x		x	x	x
Populus heterophylla L.		x	x		x	x	x
Populus tremuloides Michx.		x	x	x			
Prunus americana Marsh.		x	x		x	x	x
Prunus hortulana Bailey		x	x		x	x	x
Prunus lanata (Sudw.) Mack. & Bush				x	x	x	
Prunus nigra Ait		x					
Prunus pennsylvanica L. f.		x					
Prunus serotina Ehrh.		x	x		x	x	x
Quercus alba L.	x						
X Quercus Beadlei Trelease						x	
Quercus bicolor Willd.		x	x		x	x	x
Quercus borealis var. maxima Ashe		x	x		x	x	x

NAME OF SPECIES	REGION OF LOCATION AC	L	TP	P	LWV	K	F
Quercus coccinea Muench		x			x	x	
X **Quercus Deami** Trelease		x					
Quercus ellipsoidalis E. J. Hill		x				x	
X **Quercus exacta** Trelease					x		
Quercus Hillii Trelease		x					
Quercus imbricaria Michx.	x						
X Quercus Leana Nutt.		x				x	
X **Quercus lyrata** Walt.					x		
Quercus macrocarpa Michx.	x						
Quercus macrocarpa var. olivæformis Michx. f.			x		x		
Quercus marilandica Muench					x	x	
Quercus Muhlenbergii Englem.		x	x		x	x	
Quercus montana Willd.					x	x	
Quercus palustris Muench		x	x		x	x	x
Quercus Prinus L.					x		x
Quercus rubra L.					x	x	x
Quercus rubra var. **pagodæfolia** (Ell.) Ashe					x		
Quercus Shumardii Buckley					x		
Quercus Shumardii var. Schneckii (Britt.) Sarg.		x			x		x
Quercus stellata Wang.					x	x	
Quercus velutina Lam.	x						
Robinia Pseudo-Acacia L.	x						
Salix alba L.		x	x			x	x
Salix amygdaloides Anders.		x	x				
Salix discolor Muhl.	x						
Salix discolor var. eriocephala (Michx.) Anders.	x						
Salix fragilis L.		x	x	x		x	
Salix nigra Marsh.	x						
Sassafras officinale Nees & Eberm.		x	x		x	x	x
Taxodium distichum (L.) **L. C. Richard**					x		
Thuja occidentalis L.		x					
Tilia glabra Vent.		x	x		x	x	x
Tilia heterophylla Vent.			x			x	x
Tilia heterophylla var. **Michauxii** (Nutt.) Sarg.							x
Tsuga canadensis (L.) Carr.			x			x	x
Ulmus alata Michx.					x	x	
Ulmus americana L.	x						
Ulmus fulva Michx.		x	x		x	x	x
Ulmus racemosa Thomas		x	x			x	
Total species per area	16	115	107	23	109	107	74
Per cent. per area of 163 total trees	9	71	65	14	66	65	45

It should be noted that only 9 per cent. of all the trees are found in every county of the state. Were it not for some of the western counties being located in the Prairie region, and Benton county in particular, the per cent. of "all-over" species would be much higher.

The Prairie region has the smallest number of any of the botanical areas. It is a contradictory statement to speak of a prairie with trees, but the nature of the Indiana prairie section justifies such a remark. In the prairie counties are lobate extensions of the western prairie, thus forming a transition zone between the deciduous forest of the east and the prairie of the west. Here, the trees are confined to small wooded areas which are very limited in species (19). The Prairie of Indiana does not connote a treeless region in the true prairie sense, but suggests that botanical area which has some true prairie characteristics, but is being invaded by some deciduous trees.

The "Flats" area has the second smallest number of any of the areas, while the Lake region has the largest. The three remaining areas have about the same number. Were a more accurate distribution possible, it is certain that these figures would undergo some revision. Where a species appears throughout an area and straggles some distance into an adjacent region, it seems safe to assign that species to the area of the heavier density. But where a species is scattered, and appears in one or more counties near the limit of a botanical area, and no place else in the area, there is uncertainty in determining whether it belongs to one or the other or both of the contiguous regions. This uncertainty can not be removed, since the areas themselves are not sharply defined. As the numerical comparison of these regions now stands, it imparts but a general and not an absolute situation.

The Prairie region stands out, due to its one-sided numerical inferiority. None of the other areas are so distinguished, but some have delimited within themselves one or more species exclusively their own. It is this fact of exclusiveness that especially characterizes some of the regions.

The Lake region leads all others in the number of exclusive species. Table II enumerates the seventeen species peculiar to the Lake region, and gives the general nature of habitat for each species.

TABLE II—SPECIES EXCLUSIVE TO LAKE REGION (MAP 14)

NAME OF SPECIES	NATURE OF HABITAT		
	Swamp Bog	Upland	Sand Dune
Alnus incana	x		
Betula lutea	x		
Betula papyrifera			x
Betula populifolia			x
Carya ovalis var. obovalis f. acuta		x	
Carya ovata Nuttallii		x	
Cratægus basilica		x	
Cratægus macrosperma var. matura		x	
Larix laricina	x		
X Malus ioensis X lancifolia		x	
Pinus Banksiana			x
Populus balsamifera			x
Prunus nigra	x		
Prunus pennsylvanica	x	x	x
X Quercus Deamii		x	
Quercus Hillii		x	
Thuja occidentalis	x		
Total (17)	6	8	5

The general distribution of all the Lake region exclusives has not been worked out by anyone. This fact makes some of them impossible for mapping. If the ranges of these seventeen species were satisfactorily known, it would be too confusing to show their general distribution on a single map. In light of these facts, eight characteristic exclusive species have been chosen to represent the area. Map 14 is drawn on the basis of these eight species, each species having a number attached to give the key to its wider distribution on the map. For example, *Larix lariciana,* No. 5, covers the area indicated on the map by the vertical radius, while *Betula populifolia,* No. 1, has its distribution shown by the horizontal radius. And in like manner there is a certain numbered radius for each species. Thus the variation in shading on the map corresponds to the change in density of these eight species in the total area where they are found. In this way the geographic relationship of the eight species is indicated.

The method of selecting eight species (drawn on the map by eight different and equally disposed radii) to represent the geographic affinities of a region requires some explanation. Whenever possible, species were selected which occurred exclusively or nearly so within the Indiana area under consideration and at the same time were common enough for their distribution to be well known within and outside of the state. Some exclusives were not used for mapping because their wider distributions outside of Indiana are too poorly known. In regions where fewer than eight such exclusives were available, additional species were selected on the basis of their abundance and importance in the region to complete the group of eight species. In two regions, in particular, there was a total absence of eight such exclusives, under which condition eight characteristic species were substituted for mapping. Each radius is numbered to correspond to a certain species; and it radiates from the center of the Indiana area in which the species is found. Paralleling the radius are lines, of equal spacing, which indicate the general distribution of the species. General distribution is most easily observed by lifting the map to a horizontal position on a level with the eyes. This method of mapping has been borrowed from Dr. E. Lucy Braun, of Cincinnati University.

Some liberty was exercised in showing the general distribution of a few species on Map 14. Such being the case, some further comment is necessitated. *Betula populifolia* (radius No. 1), for instance, is shown to be in a narrow strip-like and continuous distribution to the northeast. The fact is that *B. populifolia* is a disjunct in the Lake region, being about four hundred miles from the closest of its kind (7). The unbroken distribution was made to point the direction of its wider range. *Betula lutea* (radius No. 2), though almost restricted to the Lake region, has a single specimen reported for Crawford county in the "Knobs" area (8). Aside from this one exception, *B. lutea* is preponderantly a Lake region inhabitant. *Prunus nigra* (radius No. 6), is shown as a Lake region exclusive, but it is known to exist in a few of the northern counties of the Tipton Till Plain, which lies adjacent to the Lake region on the south. But being common in the Lake region, and northern and northeastern in distribution, it suffices, in general, to illustrate the wider distribution of a Lake region exclusive.

The eight species whose wider distribution appears on Map 14 have a definitely northern range but heavier toward the northeast. Only two, *Betula lutea* and *Prunus pennsylvanica,* have their ranges extending below the latitude of the Lake region, and then only in the Appalachian mountains. These two species suggest the interesting question of what has been their route of travel in reaching northern Indiana.

MAP 14. THE WIDER DISTRIBUTION OF EIGHT LAKE REGION EXCLUSIVES

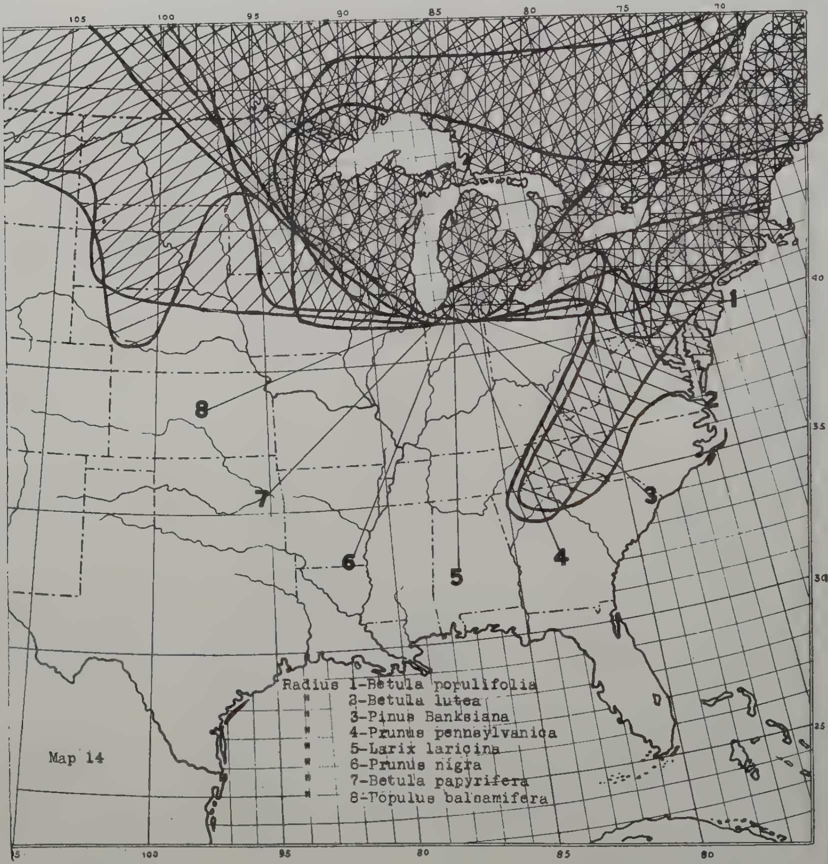


Table II shows that the more familiar exclusives of the Lake region occupy what might be termed extreme habitats, such as swamps, bogs and sand dunes. These constantly changing places of abode can not always remain suitable to the vegetation which now occupies them. When these species can no longer withstand the impact of the changing environmental factors, they will be compelled to end their Indiana sojourn (4).

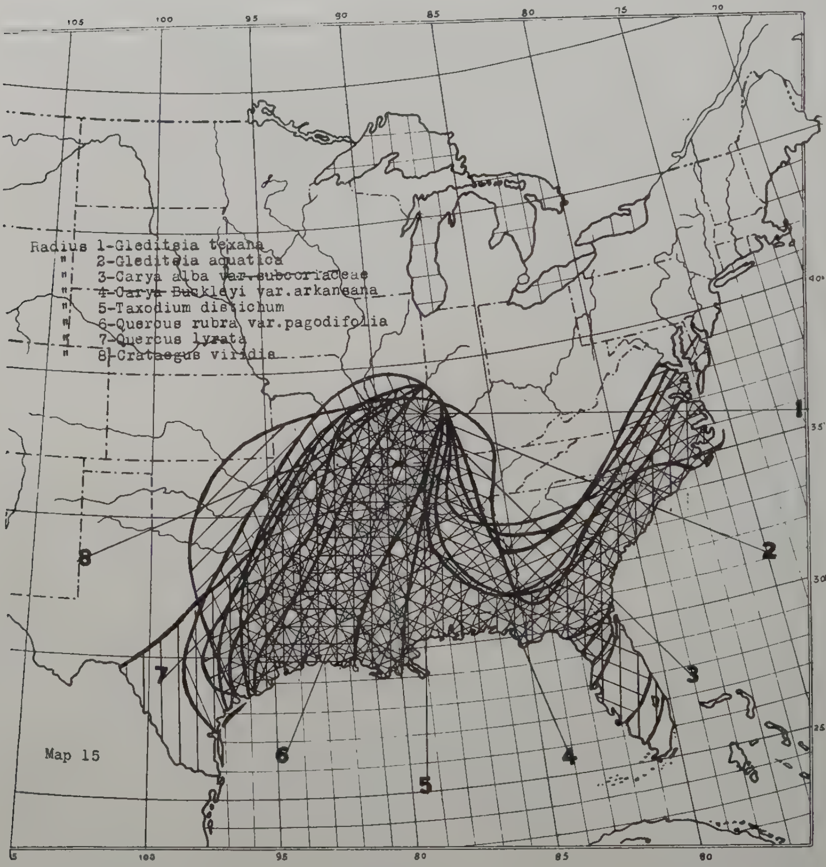
In assigning species to the Lower Wabash Valley region, Deam's delimitation of the area was largely followed, but certain liberties were taken in crediting the area with species which lie outside of the eastern boundary. Of the one hundred and nine trees occupying the Lower Wabash Valley, thirteen were found to be exclusive. These thirteen species appear in Table III and their wider distribution on Map 15.

TABLE III—SPECIES EXCLUSIVE TO LOWER WABASH VALLEY REGION (MAP 15)

NAME OF SPECIES	Species Outside Deam's Eastern Limit	NATURE OF HABITAT	
		Lowlands	Sand Ridge
Acer rubrum var. Drummondii		x	
Carya alba var. subcoriaceæ		x	
Carya Buckleyi var. arkansana			x
Carya ovalis var. obcordata f. vestita		x	
Cratægus nitida		x	
Cratægus viridis	x	x	
Fosteria acuminata	x	x	
Gleditsia aquatica		x	
Gleditsia texana		x	
Quercus exacta		x	
Quercus lyrata	x	x	
Quercus rubra var. pagodifolia		x	
Taxodium distichum	x	x	
Total (13)	4	12	1

These eight species are distinctly southern and southeastern in range. Not one of the eight shows an affinity for the Appalachian mountains. Instead, the Appalachians have been a barrier in the way of the northward invasion of all except *Gleditsia texana* and *Carya Buckleyi* var. *arkansana*, which two are not yet known to have moved eastward to an extent to have to cope with the Appalachians. Even though the northward migration of six of these trees has been interrupted by the Appalachians, yet, on either side of the mountains, these six have pushed northward. On the east they have followed the Atlantic coastal plain and Piedmont region in their northward advance, but west of the mountains they have moved northward by following the Mississippi and its tributaries. Were it not for this low and continuous passageway from the Gulf of Mexico along the Mississippi river system, it is doubtful if these eight trees would ever have entered Indiana. This is a fine example of distribution by a river system. The general distributions of these eight show them to be largely lowland trees, a fact in keeping with the nature of the habitat in which they are found in the Lower Wabash Valley.

MAP 15. THE WIDER DISTRIBUTION OF EIGHT LOWER WABASH VALLEY EXCLUSIVES



The eight Lake region exclusives are on the southern limit of their ranges, but the Lower Wabash Valley exclusives are on the northern limit of their ranges. The Lake region seems to be a door of exodus for its exclusives, while on the other hand, the Lower Wabash Valley appears to have been a gateway of entrance for its exclusives.

The "Knobs" or unglaciated region is less distinctive than either the Lake or Lower Wabash Valley regions from the standpoint of the number of exclusives. The "Knobs" has six species which are practically restricted to its area. Of the six, only *Oxydendrum arboreum, Pinus vir-*

giniana, *Æsculus octandra* and *Castanea dentata* are known in their general distribution to a degree satisfactory for mapping. These four, with four characteristic trees of the region, are listed in Table IV and are shown in their wider distribution on Map 16.

MAP 16. THE WIDER DISTRIBUTION OF SIX CHARACTERISTIC AND TWO EXCLUSIVE SPECIES OF THE "KNOBS" REGION

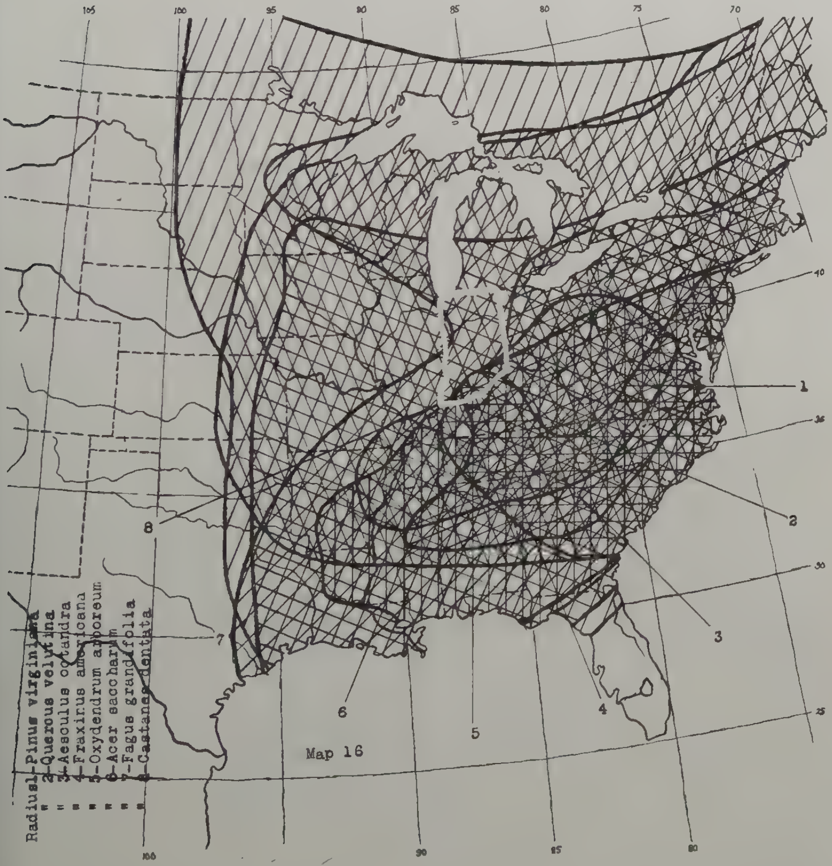


TABLE IV—EXCLUSIVE AND CHARACTERISTIC SPECIES OF THE KNOBS AREA (MAP 16)

NAME OF SPECIES	Exclusive Species	Characteristic Species	NATURE OF HABITAT	
			Upland	Lowland
Acer saccharum		x	x	x
Æsculus octandra	x		x	
Castanea dentata	x		x	
Cratægus filipes	x			
Fagus grandifolia		x	x	x
Fraxinus americana		x	x	x
Oxydendrum arboreum	x		x	
Pinus virginiana	x		x	
Quercus Beadlei	x			x
Quercus velutina		x	x	
Total (10)	6	4	8	4

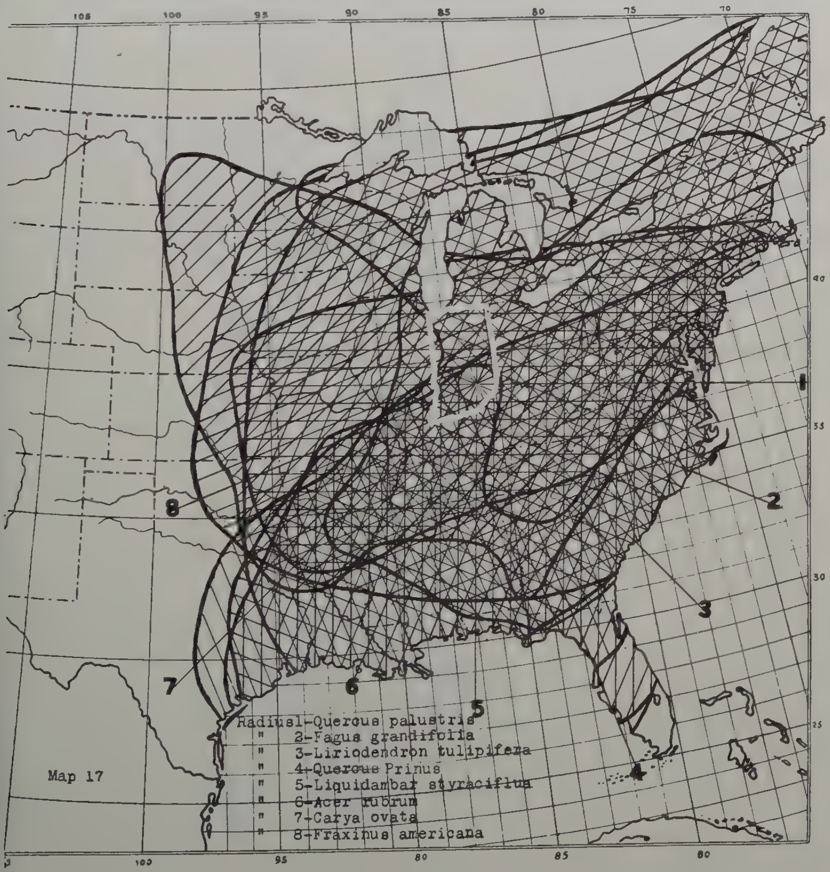
Æsculus octandra, while found in the "Knobs," is not confined to that area. It is really a tree of the Ohio river bluffs, but is similar to the "Knobs" exclusives in general distribution. Æsculus, Pinus, Oxydendrum and Castanea are on the limits of their ranges in the "Knobs" and are extraneous generally to the southeast. Castanea is the exception, in that it has also a wide distribution to the northeast. The four characteristic species are distributed fairly well over the state; and aside from *Fagus grandifolia* represent intraneous distribution. Fagus ranges well beyond Indiana to the north, east and south, but the concaved portion of its western limit is inside the western boundary of Indiana.

The "Flats" area has only *Cratægus collina* and *Tilia heterophylla* Michauxii as exclusive species; two species about whose general distribution little is known. Therefore, being unsuited for mapping, eight characteristic species were chosen to represent the area. These eight species appear in Table V and have their general distribution shown on Map 17.

TABLE V—EIGHT CHARACTERISTIC SPECIES OF "FLATS" AREA (MAP 17)

NAME OF SPECIES	NATURE OF HABITAT	
	Upland	Lowland
Acer rubrum		x
Carya ovata	x	x
Fagus grandifolia	x	x
Fraxinus americana	x	x
Liriodendron tulipifera	x	
Liquidamber styraciflua		x
Quercus Prinus		x
Quercus palustris		x
Total (8)	4	7

MAP 17. THE GENERAL DISTRIBUTION OF THE EIGHT CHARACTERISTIC SPECIES OF THE "FLATS" AREA



Of the eight characteristic species of the "Flats," *Quercus Prinus* and *Liquidambar styraciflua* have range limits in Indiana. While *Q. Prinus* is on the northern limit of its range in the "Flats," yet it has a lateral distribution to the west, including the Till Plain, "Knobs" and Lower Wabash Valley regions. The northern limit of Liquidambar is not in the "Flats," but it lies just to the north in the Tipton Till Plain. The remaining six species are well within their ranges in Indiana.

The Tipton Till Plain is credited with five species exclusive to its area: *Carya glabra* var. *megacarpa*, *Acer saccharum* var. *Rugelii*, *Cratægus coccinea* var. *Ellwangeriana*, *Cratægus Jesupi* and *Cratægus Phænopyrum*. Each of these species is reported for not more than three counties, and then the counties of location are so near the boundary between regions that it is uncertain to which botanical region they really belong. So it is with much doubt and hesitancy that these five species are classified as exclusives of the Tipton Till Plain. Table VI lists the eight characteristic species of the Tipton Till Plain. The general distribution of these eight characteristic species appears on Map 18.

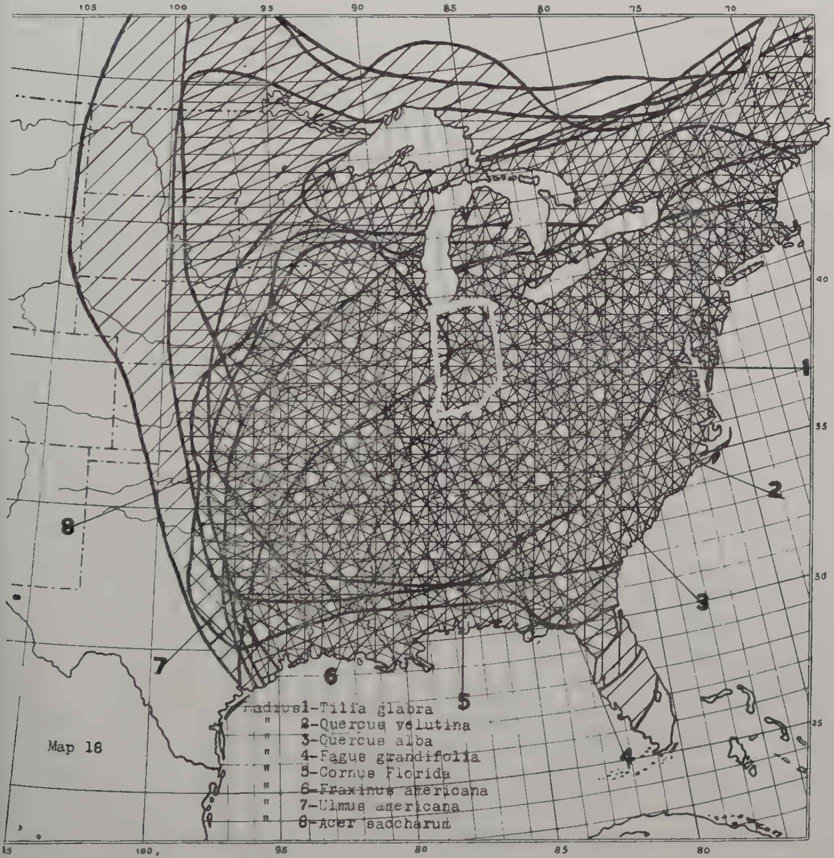
TABLE VI—EIGHT CHARACTERISTIC SPECIES OF THE TIPTON TILL PLAIN (MAP 18)

	Nature of Habitat	
NAME OF SPECIES	Upland	Lowland
Acer saccharum	x	x
Cornus florida	x	
Fagus grandifolia	x	x
Fraxinus americana	x	x
Quercus alba	x	
Quercus velutina	x	
Tilia glabra	x	x
Ulmus americana	x	x
Total (8)	8	5

The eight species which characterize the Tipton Till Plain are common trees and found generally throughout the state. In their wider distribution, they are fine examples of intraneous species. Of the five groups of trees mapped to represent as many botanical areas of the state, the eight exclusive species of the Lower Wabash Valley region range over the most restricted territory, while the eight characteristic species of the Till Plain range over the most extensive territory.

The Lake and Lower Wabash Valley regions are distinguished by

MAP 18. THE GENERAL DISTRIBUTION OF THE EIGHT CHARACTERISTIC SPECIES OF THE TIPTON TILL PLAIN



their large variety of species and by species which are exclusively their own. While this is true regarding the Lake and Lower Wabash Valley regions, the opposite is naturally true of the Prairie. It is known for the smallest variety of any botanical area and for the total absence of exclusives.

Some species with range limits in Indiana have already been mentioned in connection with the different botanical areas. But there are other species whose ranges terminate in Indiana but are not confined to a single botanical area. These species appear in Table VII.

TABLE VII—SPECIES WHICH OCCUPY MORE THAN ONE BOTANICAL AREA IN INDIANA AND WHOSE RANGES TERMINATE IN INDIANA

NAME OF SPECIES	DIRECTION OF GENERAL DISTRIBUTION					
	SW	SE	S	NE	N	NW
Carya pecan	x					
Carya glabra		x	x	x		
Carya glabra var. megacarpa		x		x		
Catalpa speciosa	x					
Acer saccharum var. Schneckii			x			
Celtis laevigata		x	x			
Cratægus collina		x				
Cratægus Phænopyrum			x			
Cratægus succulenta				x		
Diospyros virginiana	x	x	x			
Liquidamber styraciflua		x	x	x		
Magnolia acuminata			x	x		
Populus tremuloides				x	x	x
Prunus lanata	x					
Quercus ellipsoidalis						x
Quercus marilandica	x	x	x			
Quercus Prinus	x	x	x			
Quercus Montana			x	x		
Quercus rubra	x	x	x			
Quercus Shumardii var. Schneckii	x		x			
Quercus stellata	x	x	x	x		
Salix amygdaloides	x			x		x
Tilia heterophylla		x				
Ulmus alata	x	x	x			
Total (24)	12	12	14	9	1	3

SW, Southwest; SE, Southeast; S, South; NE, Northeast; N, North; NW, Northwest.

PHYSIOGRAPHIC AFFINITIES

The trees of Indiana are shown here in their distribution throughout the United States and parts of Canada according to their physiographic location. The alternative of comparing the wider distribution by states was readily suggested. And it would be an interesting bit of information to know the affinity between the trees of Indiana and those of the other states of the United States, but vegetational movements have in no way been controlled by the imaginary lines which separate states. The migratory advance or retreat of a species may be backward or forward across a designated state boundary in so far as that line is not one of habitat demarcation. But since the migration of a species is invited or repelled, in part, by physiographic factors, it seemed the better choice to compare wider distributions according to their physiographic location. A method of this kind divides the general range of Indiana trees according to natural areas, instead of political units, an arrangement of more vital interest to the botanist.

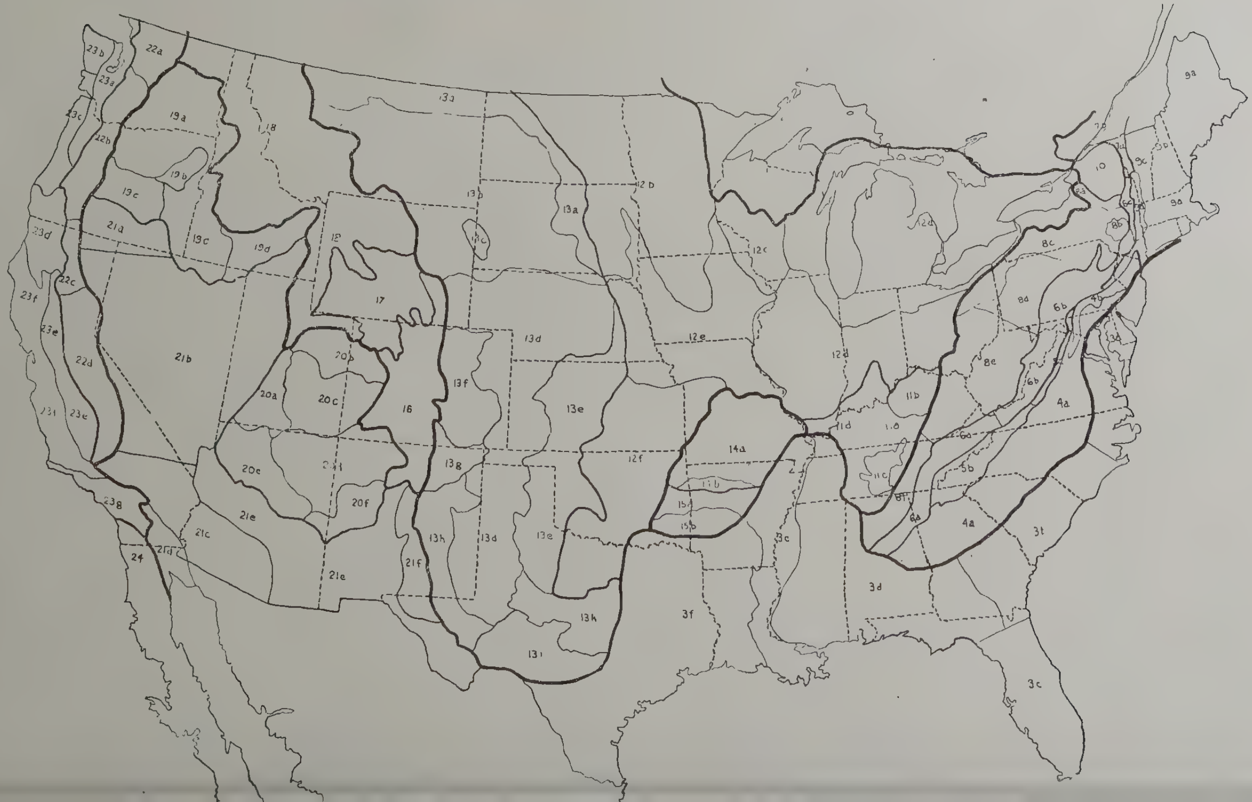
PHYSIOGRAPHIC PROVINCES OF THE UNITED STATES

Fenneman (9) has divided the United States into eight major physiographic divisions, with a further subdivision of twenty-four provinces and many lesser sections, thus supplying the best available work of its kind. The physiographic divisions of Fenneman are enumerated in Table VIII and appear in outline on Map 19. For a detailed description of these divisions, reference should be made to the work of Fenneman (9).

TABLE VIII—FENNEMAN'S PHYSIOGRAPHIC DIVISIONS

MAJOR DIVISION	PROVINCE	SECTION
Laurentian Upland	1. Superior Upland	
Atlantic Plain	2. Continental Shelf	
	3. Coastal Plain	a. Embayed section
		b. Sea Island section
		c. Floridian section
		d. East Gulf Coastal Plain
		e. Mississippi Alluvial Plain
		f. West Gulf Coastal Plain
Appalachian Highlands	4. Piedmont Province	a. Piedmont Upland
		b. Triassic Lowland
	5. Blue Ridge Province	a. Northern section
		b. Southern section
	6. Appalachian Valley Province	a. Tennessee section
		b. Middle section
		c. Hudson Valley
	7. St. Lawrence Valley	a. Champlain section
		b. Northern section
	8. Appalachian Plateaus	a. Mohawk section
		b. Catskill section
		c. Allegheny Plateau-glaciated section
		d. Allegheny Plateau-Conemaugh section

MAP 19. OUTLINE MAP OF FENNEMAN'S PHYSIOGRAPHIC DIVISIONS



MAJOR DIVISION	PROVINCE	SECTION
		e. Allegheny Plateau-Kanawha section
		f. Cumberland section
	9. New England Province	a. New England Upland
		b. White Mountain section
		c. Green Mountain section
		d. Taconic section
	10. Adirondack Province	
	11. Interior Low Plateau	a. Highland Rim Plateau
		b. Lexington Plain
		c. Nashville Basin
		d. Western (unnamed) section
Interior Plains	12. Central Lowland	a. Eastern Lake section
		b. Western Lake section
		c. Wisconsin Driftless section
		d. Till Plain
		e. Dissected Till Plains
		f. Osage Plains
	13. Great Plains Province	a. Missouri Plateau, glaciated
		b. Missouri Plateau, unglaciated
		c. Black Hills
		d. High Plains
		e. Plains Border
		f. Colorado Piedmont
		g. Raton section
		h. Pecos Valley
		i. Edwards Plateau
		k. Texas Hill section
Interior Highlands	14. Ozark Plateaus	a. Springfield-Salem Plateau
		b. Boston "Mountains"
	15. Ouachita Province	a. Arkansas Valley
		b. Ouachita Mountains
Rocky Mountain System	16. Southern Rocky Mountains	
	17. Wyoming Basin	
	18. Northern Rocky Mountains	
	19. Columbia Plateaus	a. Walla Walla Plateau
		b. Blue Mountain section
		c. Payette section
		d. Snake River Plain
		e. Harney section
Intermontane Plateaus	20. Colorado Plateaus	a. High Plateaus of Utah
		b. Uinta Basin
		c. Canyon lands
		d. Navajo section

MAJOR DIVISION	PROVINCE	SECTION
		e. Grand Canyon section
		f. Detail section
	21. Basin-and-Range Province	a. Oregon Lake section
		b. Nevada section
		c. Sonoran section
		d. Salton Trough
		e. Mexican Highland
		f. Sacramento section
	22. Sierra-Cascade Mountains	a. Northearn Cascade Mountains
		b. Middle Cascade Mountains
		c. Southern Cascade Mountains
		d. Sierra Nevada
Pacific Mountain System	23. Pacific Border Province	a. Puget Trough
		b. Olympic Mountains
		c. Oregon Coast Range
		d. Klamath Mountains
		e. California Trough
		f. California Coast Ranges
		g. Los Angeles Ranges
	24. Lower California Province	

PHYSIOGRAPHIC DISTRIBUTION

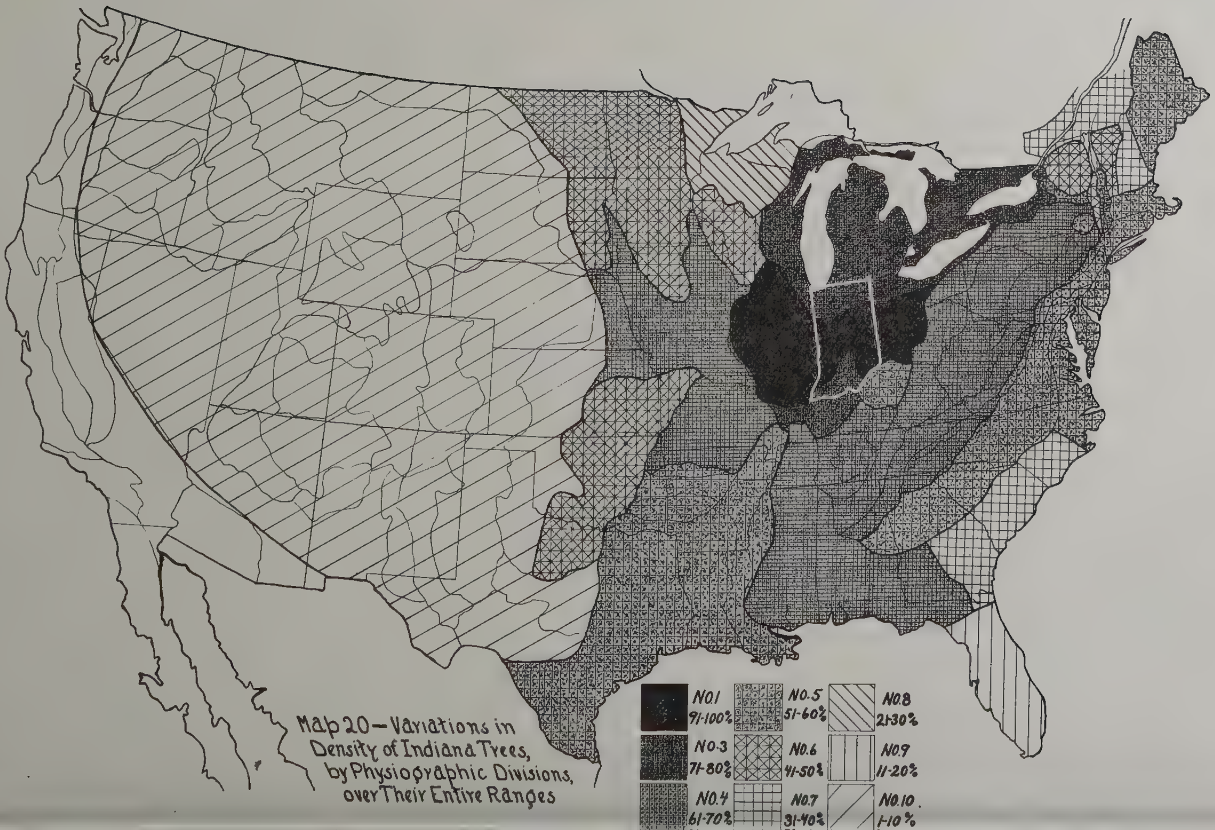
Of the 163 varieties of trees given by Deam (Table I), twenty-eigh are ignored regarding their wider distribution, due to the fact that the ranges of some of them have not been ascertained to any reliable extent that others are introduced species and the remainder are of doubtfu classification. The discarded species appear in Table IX.

The 135 trees which remain have their ranges fixed after Sargen (14), Hough (12) and Sudworth (15), with special attention given t the delimitations of the former two. A large table containing all of th physiographic areas of Fenneman was prepared. The names of the major divisions with their provinces and sections were arranged in horizontal position at the top of the sheet. The names of the 135 specie were arranged in alphabetical order and in a vertical position at the left side of the sheet. Upon learning that a species inhabited a certai province or section, it was immediately checked on the large sheet so as to indicate its occupancy in that particular area. After treating each tree in this manner, there was totalled for each province or section the number of species appearing in it, and its per cent. of the entire number

TABLE IX—DISCARDED SPECIES

NAME OF SPECIES	Indefinite Range	Introduced Species	Uncertain Classification
Alnus incana	x		
Ailanthus altissima		x	
Carya ovalis var. obcordata f. acuta	x		
Carya ovalis var. obcordata f. vestita	x		
Celtis pumila	x		
Cratægus basilica	x		
Cratægus calpodendron	x		
Cratægus chrysocarpa	x		
Cratægus coccinea var. Ellwangeriana	x		
Cratægus cuneiformis	x		
Cratægus filipes	x		
Cratægus Gattingeri	x		
Cratægus Jesupi	x		
Cratægus macrosperma	x		
Cratægus macrosperma var. matura	x		
Cratægus neo-fluvialis	x		
Cratægus nitida	x		
Cratægus rugosa	x		
Fraxinus americana f. iodocarpa	x		
X Malus ioensis X lancifolia			x
Morus alba var. tatarica		x	
Populus alba		x	
Quercus Beadlei	x		
X Quercus Deami	x		
Quercus macrosperma var. olivæformis	x		
Salix alba		x	
Salix discolor var. eriocephala	x		
Salix fragilis		x	
Total (28)	22	5	1

of 135 trees. For comparing the density of species of the different provinces and sections, per cent.-classes were found. For example, under per cent.-class No. 1 is listed the section containing between 91-100 per cent. of the 135 trees; class No. 2, the provinces and sections containing between 81-90 per cent., and other classes in descending order of 10 per cent. intervals, making ten classes in all. The result of this tabulation is shown in Table X.



Map 20—Variations in Density of Indiana Trees, by Physiographic Divisions, over Their Entire Ranges

TABLE X—PERCENTAGE CLASSES FOR SHOWING THE VARIATIONS IN DENSITY OF THE DIFFERENT PHYSIOGRAPHIC REGIONS

Per Cent. Class	No.	Physiographic Areas in Percentage Class
91-100	1	12d
81- 90	2	None
71- 80	3	11d; 12a
61- 70	4	3d; 5b; 6a, b; 8c, d, e, f; 11a, c; 12e; 14a
51- 60	5	3a, e, f; 4a, b; 5a; 8a, b; 9a, d; 11b; 14b; 15a, b
41- 50	6	6c; 9; 10; 12b, c, f
31- 40	7	3b; 7; 9b
21- 30	8	1
11- 20	9	3c
1- 10	10	13a, b, c, d, e, f, g, h, i, k; 16; 17; 18; 19a, b, c, d, e; 20a, b, c, d, e, f; 21a, b, e; 22a, b, c; 23e

The shadings on Map 20 show the variations in density of the Indiana trees over their entire range. What has been said about the botanical areas within Indiana may be applied here. Were it possible for the provinces and sections to be more sharply divided and the ranges of certain species, in particular, be more accurately drawn, it would unquestionably mean a change of shading in some instances. Especially would this be true of the Interior Plateau and the many small areas in northeastern United States. But, in the main, the map reveals the general distribution of the total of Indiana trees in relation to the same number centralized within the state.

As would be inevitable, the section of heaviest density takes in that part of Indiana which happens to include roughly the four botanical areas: Tipton Till Plain, Prairie, Lower Wabash Valley and the "Flats." But there is not a gradual diminuation of density in all directions from the section of heaviest density. Instead of this section being surrounded by a single density class of the descending order, it has four density classes, numbers 3, 4, 5 and 6 lying adjacent to it at different points. This situation means that four lanes of different numerical value radiate from a common center. All of the density classes represent a broken and irregular arrangement, due to the abrupt ending of ranges and the difference in direction of range extension. Nor is there any necessary correlation between a density class and its distance from the region of heaviest density. For instance, class number 8 is only a few hundred miles away, while class number 7 is more than twice the distance. Only four of the classes are centralized and have a general direction of extension. Class number 3, occupying the second heaviest region, is largely northern, class number 8 is northwestern, class number 9 is southeastern and class number 10 is western. The remaining four classes are not confined to a single general direction. With the exception of a few trees found in class number 10, the trees of Indiana range over the eastern half of the United States. The westward migration of these species has been held at bay by the vast prairie region of the west.

The appearance of Map 20 may suggest the distribution of trees after a haphazard manner, but the fact remains that the distribution is very orderly, being in consonance with physiographic affinity. Thus the physiographic range of a species, in a general sense, indicates the type of minor physiographic area or botanical region it occupies in Indiana.

SUMMARY AND CONCLUSIONS

1. There are certain natural botanical areas in Indiana, the major areas being the ones described by Coulter and Thompson and later modified by Deam.

2. Nine per cent. of all Indiana trees are found in every county. The quantitative relations of the different botanical areas appear in this descending order: Lake region, Lower Wabash Valley, Tipton Till Plain, and "Knobs," "Flats" and Prairie region.

3. The Lake, Lower Wabash Valley and "Knobs" regions are especially distinctive in their possession of exclusives.

4. Wherever an exclusive species is found, it is limited (in the main) to one botanical area, it is on the limit of its range and is extraneous in its distribution.

5. The extraneous species lie in three general directions from Indiana, and the direction is in direct relation to the botanical area in which the species is found: Lake region exclusives to the northeast, Lower Wabash Valley exclusives to the south and "Knobs" exclusives to the southeast.

6. Trees ranging throughout the state and most of those that are characteristic of a botanical area are intraneous species and are well within their ranges in Indiana.

7. There are no extraneous species to the west of Indiana, although

some that are extraneous to the north or south have a westward extension.

8. Forty-one per cent. of all Indiana trees are known to have range limits in Indiana. Of these, 26 per cent. are largely exclusives in one or the other of the botanical areas, and the remainder range in two or more areas, but not in all.

9. The strongest affinity of Indiana trees for physiographic provinces, in part, or totally outside of Indiana, is to the north and northeast. The direction of the weakest affinity is to the west toward the great plain and Rocky mountains.

10. The wider geographic affinities of an area are adequately indicated by a map showing the entire range of a few (eight) of the exclusive or characteristic species of an area.

11. The physiographic provinces occupied by a species indicate to some degree the nature of the minor physiographic province (botanical area) it occupies in Indiana.

The writer is especially indebted to Charles C. Deam for access to his county records of species and for his selection of characteristic trees of the different botanical areas. Without his knowledge of Indiana flora, the present problem would have been greatly impeded if not prevented. And a further debt is owed Dr. Stanley A. Cain, who suggested and directed this problem.

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PLANKTON ALGÆ OF WHITE RIVER IN MARION COUNTY AND MORGAN COUNTY, INDIANA

By C. MERVIN PALMER

During a period of thirteen months in 1930 and 1931, the algæ from 176 samples of White river water were identified. The samples were obtained from three locations near the Indianapolis Sewage Disposal Plant in Marion county and at one location in Waverly in Morgan county. Mr. C. K. Calvert, of Indianapolis, was instrumental in making possible the collection of all of this material.

It is planned to consider in a later paper the effect of sewage on the kinds of algæ present, and the periodicity of the plankton algæ at the four locations.

A list of the algæ identified by the writer is included in this article. Forms which have not been reported previously for Indiana are in boldface type. When the identification has been uncertain, a question mark is placed after the name of the alga. The number after each name indicates the number of samples out of the 196 samples examined in which each alga was found. The presence of each alga in samples from Marion county and from Morgan county is indicated by the "x's" in the columns at the right of the list. In some cases, especially with diatoms, specimens were identified to genus only. When more than one species of a genus has been identified, the information is also summarized for the genus. Not including this last group of genus names, there are 182 kinds of algæ given in the list. This would be the minimum number of species represented in the list. It includes 120 species which are new for Indiana. In the list are eighty-four genera, of which twenty-six are new for the State.

PLANKTON ALGÆ OF WHITE RIVER

		Number of Samples Containing Alga	Marion County	Morgan County
1	**Actinastrum**	36	x	x
2	**A. gracillimum** Smith	34	x	x
3	Anabæna	4	x	
4	Ankistrodesmus falcatus (Corda) Ralfs	67	x	x
5	Asterionella	9	x	x
6	**Brachiomonas**	1		x
7	Chætophora	1	x	
8	Characium limneticum Lemm. ?	4	x	
9	**Chlamydobotrys gracilis** Korschikoff	2	x	
10	Chlamydomonas	104	x	x
11	**C. communis** Snow	9	x	x
12	**C. globosa** Snow	4	x	x
13	**C. gracilis** Snow	2		x
14	**C. nivalis** (Bauer) Wille	1	x	
15	Chlorella	23	x	x
16	**C. vulgaris** Beyerinck	6	x	x
17	Chroöcoccus	6	x	x
18	**C. limneticus** Lemm.	2	x	x
19	**C. minutus** (Ktz.) Näg.	3	x	
20	**Chrysosphæra**	1	x	
21	Cladophora	2	x	x
22	**Closteriopsis longissima** West	15	x	x
23	Closterium	44	x	x
24	C. acutum (Lyng.) DeBreb.	1	x	
25	C. gracile DeBreb.	29	x	x
26	C. moniliferum (Bory) Ehr.	1		x
27	Cocconeis	9	x	x
28	Cœlastrum	54	x	x
29	C. cambricum Arch.	3	x	
30	C. microporum Näg.	53	x	x
31	Cœlosphærium	1	x	
32	Crucigenia	19	x	x
33	**C. apiculata** (Lemm.) Schmidle	1		x
34	**C. crucifera** (Wolle) Collins	5	x	x
35	**C. fenestrata** Schmidle	2		x
36	**C. irregularis** Wille	3	x	x
37	**C. lauterbornei** Schmidle	1		x
38	**C. quadrata** Morren	11	x	x
39	**Cryptomonas**	33	x	x
40	**C. anomala** Fritsch	1		x

		Number of Samples Containing Alga	Marion County	Morgan County
41	Cyclotella	95	x	x
42	Cymbella	4	x	x
43	Diatoma	49	x	x
44	Dictyosphærium pulchellum Wood	8	x	x
45	Dinobryon	7	x	x
46	**D. sociale** Ehr.	1	x	
47	**D. stipitatum** Stein	2	x	
48	**D. tabellariæ** (Lemm.) Pascher	2	x	x
49	Epithemia ?	6	x	x
50	Eudorina	17	x	x
51	**E. elegans** Ehr.	15	x	x
52	Euglena	134	x	x
53	E. acus Ehr.	27	x	x
54	**E. acutissima** Lemm.	2	x	
55	**E. deses** Ehr.	36	x	x
56	**E. ehrenbergii** Klebs	1	x	
57	**E. fusca** (Klebs) Lemm. ?	2	x	x
58	**E. gracilis** Klebs	13	x	x
59	**E. intermedia** (Klebs)	1		x
60	**E. limnophila** Lemm.	2	x	x
61	**E. pisciformis** Klebs	2	x	x
62	**E. polymorpha** Dangeard ?	3	x	
63	**E. proxima** Dangeard	98	x	x
64	E. spirogyra Ehr.	33	x	x
65	**E. splendens** Dangeard ?	1		x
66	**E. terricola** (Dangeard) ?	1	x	
67	**E. tripteris** Dujard.	3	x	
68	**E. truncata** Walton	9	x	x
69	**E. variabilis** Klebs	3	x	x
70	E. viridis Ehr.	12	x	x
71	**Eutreptia viridis** Perty ?	1	x	
72	Fragilaria	12	x	x
73	**Gloeocystopsis limneticus** G. M. Smith	1		x
74	**Golenkinia**	6	x	x
75	**G. paucispina** W. and G. S. West	5	x	x
76	**G. radiata** Chodat	1		x
77	Gomphonema	10	x	x
78	Gonium	2	x	
79	G. pectorale Müller	1	x	
80	**Gymnodinium**	4	x	x
81	**G. æruginosum** Stein ?	1	x	
82	**G. paradoxum** Schilling	2	x	x

		Number of Samples Containing Alga	Marion County	Morgan County
83	**Hormidium**	1	x	
84	**Kirchneriella obesa** (W. West) Schmidle	1		x
85	**Lagerheimia**	4	x	x
86	**L. chodati** Bern	2	x	x
87	**L. citriformis** (Snow) G. M. Smith	1	x	
88	**L. droescheri** (Lemm.) Printz	1	x	
89	**Lepocinclis**	11	x	x
90	**L. globosa** Francé	1	x	
91	**L. sphagnophila** Lemm. ?	2	x	
92	**L. teres** (Schmitz)	1	x	
93	**L. texta** (Dujardin)	8	x	x
94	Lyngbya	25	x	x
95	**L. ærugineo-cærulea** (Ktz.) Gom.	1	x	
96	**L. digueti** Gom. ?	5	x	x
97	**L. distincta** (Nordstedt) Schmidle ?	3	x	
98	**L. lagerheimii** (Möb.) Gom.	2	x	x
99	**L. nana** Tilden ?	4	x	x
100	**L. putealis** Mont. ?	6	x	
101	**L. subtilis** W. West	3	x	x
102	Melosira	6	x	x
103	Merismopedia glauca (Ehr.) Näg.	1	x	
104	Mesotænium caldariorum (Lag.) Hansg.	1	x	
105	**Micractinium**	31	x	x
106	**M. pusillum** Fresenius	30	x	x
107	Microcystis	3	x	
108	M. æruginosa Ktz.	1	x	
109	**M. flos-aquæ** (Wittr.) Kirchner	2	x	
110	**M. incerta** Lemm.	1	x	
111	Microspora	6	x	x
112	**M. stagnorum** (Ktz.) Lag. ?	1	x	
113	**M. tumidula** Hazen	1		x
114	Mougeotia (or Debarya ?)	2	x	
115	Navicula	143	x	x
116	Nephrocytium agardhianum Näg.	1	x	
117	Nitzschia	40	x	x
118	**Oocystis**	8	x	x
119	**O. borgei** Snow	4	x	
120	**O. pusilla** Hansg.	4	x	x
121	Ophiocytium capitatum Wolle	2	x	
122	Oscillatoria	94	x	x
123	**O. agardhii** Gom.	28	x	x
124	**O. amphibia** Ag.	8	x	x

		Number of Samples Containing Alga	Marion County	Morgan County
125	**O. boryana** Bory	1		x
126	O. brevis Ktz.	3	x	
127	O. chalybea Mert.	37	x	x
128	**O. chlorina** Ktz.	9	x	x
129	**O. formosa** Bory	5	x	x
130	**O. geminata** Menegh.	1		x
131	O. limosa Ag.	5	x	x
132	**O. minnesotensis** Tilden	1	x	
133	**O. numidica** Gom. ?	7	x	x
134	**O. sancta** Ktz.	2	x	
135	O. splendida Grev.	1	x	
136	**O. subsalsa** Ag.	2		x
137	**O. subtilissima** Ktz.	10	x	
138	O. tenuis Ag.	14	x	x
139	**O. terebriformis** Ag.	3	x	x
140	Palmella	1		x
141	Pandoriña morum Bory	33	x	x
142	Pediastrum	84	x	x
143	P. boryanum (Turp.) Menegh.	54	x	x
144	P. duplex Meyen	71	x	x
145	P. simplex Meyen	34	x	x
146	P. tetras (Ehr.) Ralfs	7	x	x
147	Phacus	43	x	x
148	**P. acuminata** Stokes	2	x	
149	**P. caudata** Hübner ?	1	x	
150	**P. longicauda** (Ehr.)	21	x	x
151	P. pleuronectes (Mull.)	24	x	x
152	P. pyrum (Ehr.)	5	x	x
153	**P. triqueter** (Ehr.)	13	x	x
154	Phormidium ?	2	x	
155	**P. retzii** (Ag.) Gom. ?	1	x	
156	P. uncinatum (Ag.) Gom. ?	1	x	
157	Pleodorina	9	x	x
158	P. illinoisensis Kofoid	8	x	x
159	**Pleurocapsa** ?	12	x	x
160	Pleurosigma	2	x	
161	**Polyedriopsis spinulosa** Schmidle	2	x	x
162	Scenedesmus	142	x	x
163	S. abundans (Kirchner) Chodat	4	x	x
164	**S. acuminatus** (Lag.) Chodat	4	x	x
165	**S. arcuatus** Lemm.	4	x	x
166	**S. bijuga** (Turpin) Lag.	7	x	x

		Number of Samples Containing Alga	Marion County	Morgan County
167	**S. denticulatus** Lag.	6	x	x
168	S. dimorphus (Turpin) Ktz.	72	x	x
169	**S. longus** Meyen	8	x	x
170	S. obliquus (Turpin) Ktz.	16	x	x
171	**S. opoliensis** Richter	61	x	x
172	S. quadricauda (Turpin) Breb.	138	x	x
173	**Selenastrum**	5	x	x
174	**S. bibraianum** Reinsch	3	x	x
175	**S. westii** G. M. Smith	2	x	x
176	Sphærocystis schrœteri Chodat	30	x	x
177	Spirogyra	15	x	x
178	Spirulina major Ktz.	2	x	
179	Staurastrum	1	x	
180	Stichococcus **scopulinus** Hazen ?	1	x	
181	Stigeoclonium	3	x	x
182	**S. lubricum** Ktz.	2	x	x
183	Surirella	5	x	x
184	**Synechococcus racemosus** Wolle	2	x	
185	**Synechocystis aquatilis** Snow	2	x	x
186	Synedra	156	x	x
187	**Synura**	7	x	x
188	**S. uvella** Ehr.	3	x	x
189	Tabellaria	51	x	x
190	**Tetradesmus**	1		x
191	Tetraëdron	10	x	x
192	**T. gracile** (Reinsch) Hansg.	1	x	
193	**T. hastatum** (Reinsch) Hansg.	1	x	
194	**T. regulare** Ktz.	6	x	x
195	T. trigonum (Näg.) Hansg.	4	x	x
196	**Tetrastrum**	3	x	
197	**T. staurogeniæforme** (Schröder) Lemm.	2	x	
198	Trachelomonas	19	x	x
199	**T. caudata** (Ehr.)	1		x
200	**T. conspersa** Pascher ?	1	x	
201	**T. crebea** Kellicott	2	x	
202	**T. fluviatilis** Lemm.	1	x	
203	**T. globularis** (Awerinz.)	2	x	x
204	T. hispida (Perty)	5	x	x
205	**T. intermedia** Dangeard	1	x	
206	**T. oblonga** Lemm. ?	1		x
207	**T. piscatoris** (Fisher)	1	x	
208	**T. urceolata** Stokes	2	x	

		Number of Samples Containing Alga	Marion County	Morgan County
209	**T. volvocina** Ehr.	4	x	
210	**T. westii** Wolosz.	2	x	
211	Tribonema	49	x	x
212	T. bombycinum (Ag.) Derbes et Solier	2	x	x
213	**T. minus** (Wille) Hazen	44	x	x
214	Ulothrix **tenerrima** Ktz.	1	x	
215	**Vacuolaria** ?	1	x	
216	**Westella** ?	9	x	x
217	**W. botryoides** (W. West) de Wildeman ?	7	x	x